Hardness and Crack Resistance of Oxide Network Glasses

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Predicting the properties of new glasses prior to manufacturing is a topic attracting great industrial and scientific interest, but the lack of long-range order and the long time scales for relaxation greatly complicate the traditional modeling efforts. Mechanical properties are currently of particular interest given the increasing demand for stronger, thinner, and more flexible glasses in recent years. Here we review our recent findings on predicting and understanding the indentation derived mechanical properties of oxide network glasses of industrial interest. For example, we have enabled quantitative calculations of glass hardness using temperature dependent constraint theory. We have also revealed the effects of different composition variables, thermal history, pressure history, and humidity on hardness and crack resistance of borosilicate and aluminosilicate glasses.